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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/222,588	12/28/98	LI L	P0424/LAM1P0

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EXAMINER	
HASSANZADEH,P	
ART UNIT	**PAPER NUMBER**
1763	5

DATE MAILED: 01/06/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/222,588	LI ET AL.	
	Examiner	Art Unit	
	Parviz Hassanzadeh	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *28 December 1998* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 December 1998* is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☒ Notice of References Cited (PTO-892)
15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4* .
17) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other: .

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

It is suggested to delete "reactive" on page 3, line 1,

It is suggested to move the "semiconductor " to before "substrate" on page 3, line 2 .

Appropriate correction is required.

Drawings

2. Figures 1 and 2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

3.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 2, 4, 6, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

The admitted Prior Art by the present Applicants disclosed on pages 7-8 and Fig. 2 teach all limitations of the claimed apparatus comprising a reactor 100, a chamber wall 102, top electrode 104 coupled to an RF power 106 and includes a plurality of gas distribution holes 105, a top shroud 108 surrounding the top electrode 104, a bottom electrode 110 coupled to an RF power 112 and also includes an electrostatic chuck that secures a substrate 114, a focus ring 116 surrounding the bottom electrode 110 and is made of ceramic material such as aluminum oxide, a silicon ring 118 surrounding the edge of the substrate 114, a teflon shroud (liner) 120, and a confinement ring 122 that is made of an insulating material and is floating.

The disclosed admitted Prior Art fail to teach a liner made of a material that is resistant to etching and electrically floating during plasma processing, and a plasma confinement which is located around and below the surface of the workpiece and is made of electrically conductive material.

Shan, et al. teach a chamber liner 44 installed over a portion of the interior wall of the reactor chamber to reduce the effective area of the first (top) electrode and thus reduce the dc bias on the second (bottom) electrode (column 2, lines 55-63). Further control of the dc bias is provided by changing the materials used for the chamber liner 44. Although preferably a dielectric material, the chamber liner may also be a semiconductor material, or even a conductor such as anodized aluminum. (column 5, lines 32-36). A plasma shield 30, made of a dielectric material (column 2, lines 43-54), is connected to the chamber wall which is grounded.

Hiroto et al. also teach a plasma shield (baffle) 35 positioned around the substrate holder (Fig. 1). The plasma shield 35 is composed of an insulating material (abstract) and is connected to the chamber wall which is grounded.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the liner and the grounded plasma shield as taught by Shan, et al. or the grounded plasma shield as taught by Hiroto, et al. in the apparatus shown in Fig. 2 (admitted Prior Art) instead of the teflon liner 120 and plasma confinement ring 122 in order to avoid material deposition on the wall and also operate at a lower dc bias voltage and thus avoiding the problems associated with high dc bias.

7. Claims 3, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637).

The admitted Prior Art, disclosed on pages 7-8, and Fig. 2 and Shan, et al. teach all limitations of the claims as discussed above as well as a mechanism for adjusting the distance 132 between the top and bottom electrodes. A screw linear actuator moves the top electrode 104 up and down and change the distance between the electrodes to an optimized value which may be any value including 0.5-2 inches.

8. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A) as applied to claims 1, 2, 4, 6, 9 above, and further in view of Tomoyasu, et al. (US Patent No. 5,900,103).

The admitted Prior Art disclosed by the Applicants, Shan, et al., and Hiroto, et al. teach all limitations of the claims as discussed above except for the explicit value of the RF applied to the electrodes.

Tomoyasu, et al. disclose a plasma reactor including a showerhead (top) electrode 21 and a bottom electrode 5 (Fig. 1). A high frequency of 10 MHz or more is applied to the top electrode and a lower frequency of 5 MHz or lower to the bottom electrode (column 2, lines 3-34). In one embodiment, a frequency of 27 MHz is applied to the top electrode (column 5, line37-40).

Selection of the optimized radio frequency values for the electrodes from the teaching of Tomoyasu, et al. would have been obvious to one of ordinary skill in the art at the time of invention.

9. Claims 10, 112 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637).

The admitted Prior Art disclosed on pages 7-8 and Fig. 2 and Shan, et al. teach all limitations of the claims as discussed above except for the explicit ratio of the diameter of the chamber liner to plasma shield ring.

The ratio of the diameter of the chamber liner and the plasma shield ring does not appear to be critical and is considered to be a design choice that would have been obvious to one of ordinary skill in the art at the time of invention.

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

The admitted Prior Art disclosed on pages 7-8 and Fig. 2 and Shan, et al. teach all limitations of the claims as discussed above including a plasma shield made of a dielectric material (column 2, lines 43-54).

Hiroto, et al. also teach a plasma shield (baffle) 35 composed of insulating material (abstract).

Change of the dielectric and insulating materials as taught by Shan, et al. and Hiroto, et al., respectively, to a conductor is considered to be an obvious modification that would have been obvious to one of ordinary skill in the art at the time of invention.

11. Claims 12, 14-20, 22, 23, are rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

The admitted Prior Art disclosed on pages 7-8 and Fig. 2 and Shan, et al. teach all limitations of the claims as discussed above. Furthermore, Shan, et al. teach a plasma shield 30 that blocks the plasma from forming in part of the reactor chamber 10. The plasma screen 30 includes a number of small slits 40 extending through the entire thickness of the screen and provide a path for process gases to be drawn down into the region 32 and out through the exhaust port 34. (column 4, lines 31-64).

As shown in Fig. 2 (Shan, et al.), the plasma screen 30 may be an annular element with arcuate slits 40 formed in it, but other forms of the screen such as circular holes instead of slits may also be used. The number, size and spacing of the openings, may also be optimized. (column 4, line 65 through column 5, line 8).

Hiroto et al. also teach a plasma shield (baffle) 35 which has holes 34 through it in order to confine the plasma and to permit the plasma exhaust gases to leave the reactor. As shown in Figs. 1-4, the holes are inclined to increase the gas conductance.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the shape, size, depth, and the percentage of the holes in the plasma shield in order to optimize and improve the performance of the plasma shield.

12. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Prior Art admitted by the present Applicants (pages 7-8 and Fig. 2) in view of Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

The admitted Prior Art, disclosed on pages 7-8, and Fig. 2 and Shan, et al. teach all limitations of the claims as discussed above; however, the distance between the surface of the substrate to the surface of the plasma shield in the apparatus of Shan, et al. is not clearly mentioned even though the plasma shield is located apparently (Fig. 1) just below the surface of the substrate.

Hiroto, et al. also teach a similar plasma shield (baffle) 35 in Fig. 1 that is located around and below the surface of the substrate.

Even though the distance between the surfaces of the plasma shield and the surface of the substrate is not explicitly disclosed in either of the prior arts mentioned, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust this distance in order to obtain an optimized location for the plasma shield.

13. Claims 24, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

Shan, et al. teach a plasma shield 30 (Fig. 1), made of a dielectric material (column 2, lines 43-54), is connected to the chamber wall which is grounded. The plasma screen has a plurality of holes 40 for passage of gas (column 4, lines 46-50).

Hiroto et al. also teach a plasma shield (baffle) 35 including a plurality of holes 34 that is positioned around the substrate holder (Fig. 1). The plasma shield 35 is composed of an insulating material (abstract) and is connected to the chamber wall which is grounded.

Shan, et al. and Hiroto, et al. fail to teach a plasma shield made of an electrically conductive material.

Shan, et al. also teach a chamber liner 44 installed over a portion of the interior wall of the reactor chamber to reduce the effective area of the first (top) electrode and thus reduce the dc bias on the second (bottom) electrode (column 2, lines 55-63). Further control of the dc bias is provided by varying the selection of the materials used for the chamber liner 44. Although preferably a dielectric material, the chamber liner may also be a semiconductor material, or even a conductor such as anodized aluminum. (column 5, lines 32-36).

Similar to the chamber liner, selection of conductive material rather than a dielectric or insulating material as taught by Shan, et al. and Hiroto, et al. is considered an obvious modification choice to one of ordinary skill in the art at the time of invention.

14. Claims 25, 27-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shan, et al. (US Patent No. 5,605,637) and Hiroto, et al. (JP 07-245295A).

Shan, et al. and Hiroto, et al. teach all limitations of the claims as discussed above. Furthermore, Shan, et al. teach a plasma shield 30 that blocks the plasma from forming in part of the reactor chamber 10. The plasma screen 30 includes a number of

small slits 40 extending through the entire thickness of the screen and provide a path for process gases to be drawn down into the region 32 and out through the exhaust port 34. (column 4, lines 31-64).

As shown in Fig. 2 (Shan, et al.), the plasma screen 30 may be an annular element with arcuate slits 40 formed in it, but other forms of the screen such as circular holes instead of slits may also be used. The number, size and spacing of the openings, may also be optimized. (column 4, line 65 through column 5, line 8).

Hiroto et al. also teach a plasma shield (baffle) 35 which has holes 34 through it in order to confine the plasma and to permit the plasma exhaust gases to leave the reactor. As shown in Figs. 1-4, the holes are inclined to increase the gas conductance

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the shape, size, depth, and the percentage of the holes in the plasma shield in order to optimize and improve the performance of the plasma shield.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703)308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703)305-5408 for regular communications and (703)305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

Parviz Hassanzadeh
December 28, 1999

RICHARD BUEKER
PRIMARY EXAMINER
ART UNIT 1763